Hacking the Collective:
The Role of Technology, Production, and the Social in Hackerspace Collectivity

By

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August 2013

Introduction

In 2006, at the *Haus des Lehrers* in what was once East Berlin, the German-based Chaos Computer Club hosted its twenty-third annual Chaos Communication Congress.[1] This international symposium of hackers was followed by an outdoor version of the congress which has been held every four years since 1999, and that is appropriately referred to as the Chaos Communication Camp.[2] In 2007, the camp took place at a retired airfield in Finowfurt, a small town located about 50 kilometers north of Berlin, and was attended by hackers from Europe, North America, and other locations around the world. For five days in August, the hangars, tarmacs, and open spaces surrounding the airfield were converted into a vibrant community of tent villages complete with communal workspaces, art installations, places for eating and drinking, and a large green rocket—carefully positioned to appear as if it had touched down in a clearing next to the tents. An extensive infrastructure was also built to provide power, communications, and high-speed Internet access for the camp's attendees. In addition to the socializing, tinkering, and hacking that took place that week, there were also numerous presentations, one of which was a talk that had also been given at the Chaos Communication Congress late the prior year. In this talk, a model was presented for the creation of permanent physical spaces in which communities could form around shared interests in hacking and technology, and which by then were already being referred to quite obviously as hackerspaces.

Inspired by the communities described during these presentations (along with those encountered on a tour of European hackerspaces that took place following the camp), hackers who had been in attendance from the U.S. and elsewhere soon began working to establish similar spaces outside of Europe.[3] Although hackerspaces vary considerably and

tend to reflect the social and cultural nuances of the locality in which they are situated, they might generally be conceived of as spatial and technological infrastructures created to facilitate a broad range of practices related to hacking and an informal, self-determined approach to production. Oftentimes, these infrastructures are also designed to be largely open and modifiable by those who use them—something which is achieved through an extensive weaving together of electronics and communications technologies with the material aspects of the space.

Also embedded in the hackerspace design pattern, however, is a basic model for creating open, non-hierarchical communities consisting of basic processes for decision making, adding new members, and resolving the disputes which inevitably arise among groups often characterized by a diverse set of interests and beliefs. In a more fundamental sense, the hackerspace model establishes a flexible framework for the collective negotiation of ideals related to openness, inclusion, and personal freedom with a practical need for order and decision making. Instead of constituting a fixed or concrete pattern for collectivity, however, many of the design elements underlying the hackerspace model are themselves meant to be open and modifiable. Constituting what is perhaps the only consistent exception to this are basic principles of individual freedom and mutual respect, as well as a general commitment to equality—ideals that are typically treated as ethical standards against which interactions and decisions are assessed. The hackerspace model also involves the establishment of an extensive communications infrastructure to facilitate remote interaction and the sharing of information, including the use of online wikis, chat forums, and what are often numerous e-mail discussion groups within a single community.

Given the apparent emphasis placed by these communities on openness, inclusion, and personal liberty—as well as the freedom of expression this implies—it is tempting to search for the potential of an emergent public within the context of the hackerspace. This would indeed be consistent with the considerable attention that has been given to the potential for a viable public sphere or meaningful political action in contemporary society (Sheller, 2004; Gandy, 2004 and 2005; Bernal, 2005; Juris, 2005 and 2012), constituting an apparent response to the loss of political orientation implied by what Jameson describes as the "flatness or depthlessness" (1990: 60) of the postmodern social environment. While this search for a viable postmodern public is truly compelling, it can also lead to the imposition of an over-determined notion of the public on collective forms which are, in reality, far more complex than any mere public or private interpretation. As a result, rather than searching for the potential existence of a distinct and sustained public sphere of human interaction, it is instead possible to consider the public and the private as embedded aspects of a more complex, constantly shifting form of collectivity.

The question, then, should not be whether hackerspaces offer the potential for a viable public sphere to emerge, or what novel forms of political action can be identified in the context of these communities. Instead, a far more interesting question that can be asked is, quite simply, what sort of collectivity *is* the hackerspace? Given the apparent orientation of hackerspace communities around a shared interest in technology and informal production, the question might also be posed, how can this particular form of collectivity be thought in terms of the relation to technology and production found in these communities? Rather than clinging to a simple dichotomy of public and private, these questions lead to a line of inquiry which opens itself to the complex forms of collectivity and interaction

encountered in hackerspace communities, and one which will therefore serve as the starting point of this discussion.

In exploring this complexity, I contend that hackerspaces point to a novel form of collectivity rooted in a generalized notion of hacking which transcends mere practice, and that should rather be thought as a particular way of thinking and being in relation to the world—a stance which is readily apparent in the interactions, practices, and productive activities found in the context of the hackerspace. In attempting to unravel the collective form encountered in these communities, I draw primarily on research performed at Noisebridge—a hackerspace located in the Bay Area of northern California that was founded shortly after the Chaos Communication Camp in 2007. I also introduce the metaphor of *wiki communities*, thus allowing for a clearer conception of the complex ways in which these groups produce and interact with the infrastructural forms that constitute an inseparable aspect of hackerspace collectivity. In doing so, I call attention to the active role played by technology, materiality, and space in the hackerspace environment, as well as the various connections and orientations characterizing the relationship between these communities and the broader social and political context in which they are situated.

Methods

This paper is the culmination of ethnographic research performed on the Noisebridge hackerspace in San Francisco, and relies upon personal interviews and observations conducted both in-person and online. Additional research was also performed remotely on several other hackerspaces in the U.S. and Europe, and regarding the general emergence of hackerspaces and similar communities during the last two decades. As

groups which embrace Internet technology and virtual interaction, a great deal of information regarding the emergence of hackerspaces is available online, and the value of this information should not be overlooked. In many cases, the Internet provides an important collective record produced by these communities—especially in the prolific use of online wikis—and contains information which would be difficult or even impossible to obtain otherwise.

In the case of Noisebridge, in-person observations were performed in both relatively informal settings aimed at capturing the quotidian practices and interactions of those involved in the community, and in more formal settings such as organized events and classes held in the space. These observations were augmented by personal interviews and time spent embedded in the various sites of online interaction used by the group, with a particular focus on the community's e-mail discussion forum and online wiki. In addition to an Internet Relay Chat (IRC) channel and a considerable amount of Internet media produced by the group, the online wiki and e-mail discussion forum constitute important sites of interaction for Noisebridge. They also provide a vital link to other hackerspace communities, and serve as spaces of representation to those unfamiliar with the group.

Similar to many hackerspaces, Noisebridge takes a relatively open stance with respect to outsiders and is lacking in any formal hierarchy. While officers are elected by the community, their role is largely administrative and there is no official spokesperson for the group. As a result, gaining entry into Noisebridge—and hackerspaces in general—is a relatively simple affair. Obtaining permission to research a hackerspace is, however, quite a different matter and can be exceedingly problematic in that no single person is authorized to grant access to the community. In the case of Noisebridge, the community operates

based on a minimal set of principles that reflect a fundamental orientation towards personal freedom and self-determined action moderated only by an imperative to treat others with "excellence,"[4] and a decision-making process based on consensus in which authority is exercised collectively by the standing members of the group.[5] As a result, and given the community's open stance towards outsiders, permission must necessarily be obtained on an individual basis from respondents throughout the research process.

It should also be noted that personal privacy is of considerable importance to many of those active in the community. This desire for privacy is problematic, however, given that Noisebridge's physical space and online forums are largely accessible to anyone, and also considering the regular presence of skilled computer hackers active in the space. As a result, and in spite of the open stance taken by the community, there is a great deal of attention given to both physical and electronic security in the space—evident in the community's use of Tor[6] software, and the manner in which online interactions are often conducted using pseudonyms. Out of respect for the community's emphasis on personal privacy, and due to the fact that many of the projects encountered during my research were highly specific and might easily be linked to a specific person or persons in the group, care has been taken to separate descriptions of individual projects from the personal comments and opinions offered by respondents.

Literature Review

Possibly due to the recency of their emergence, little research has been published which focuses directly on hackerspaces. Numerous authors have, however, attended to the many social, cultural, and technological practices that have arisen specifically in relation to

computer hacking. Although representing a more mainstream interest in the subject, Levy's *Hackers: Heroes of the Computer Revolution* (1984) continues to provide a great deal of insight into groups oriented around a shared interest in hacking and computer technology. Levy does this by exploring the emergence of computer hacking among a small but dedicated group of students and faculty at the Massachusetts Institute of Technology (MIT) during the 1950s and 1960s, followed by its meteoric proliferation into a diffuse body of social and practical forms during the years that followed.

In addition to providing an important window into the early development of computer hacking, Levy also outlines what he perceives as a consistent cultural thread evident among computer hackers, or what he refers to simply as the "Hacker Ethic" (Levy, 1984: 26). In outlining this ethic, Levy describes a general mistrust of authority, an aversion to bureaucracy and inefficiency, a profound curiosity, and an incessant questioning of preexisting beliefs and practices among early hackers (1984: 27-30). There is also a clear playfulness and competitiveness apparent in the early emergence of computer games, a fundamental belief that information should be free, and an in intensely optimistic, almost utopian pursuit of technological and social perfection (Levy, 1984: 27, 33-36, 66, 75, 48-49). In describing these basic themes, Levy focuses primarily on small, close-knit communities of early hackers who are brought together by a shared passion for the seemingly unlimited potential associated with computer technology and the production of the virtual, as well as the obvious pleasure arising from acceptance into an elite and like-minded group of individuals. Only later, with the rise of personal computing and the advent of Internet technology, does Levy describe how direct interaction among hackers grew increasingly diffuse (Levy, 1984: 282, 313-331)—thus pointing to an apparent loss of

physical, in-person community among hackers. While offering a rather homogenized notion of computer hacking, Levy's portrayal does touch on a number of important themes that also recur with surprising frequency in hackerspace communities.

More recently, Coleman (2013) attends to computer hacking in the context of free and open-source software, or F/OSS, which she describes as a cultural response to existing government approaches to intellectual property that favor corporate interests over individual freedoms pertaining to production and self-expression (2013: 4, 67-68, 73). Coleman connects this intensification of intellectual property law to a broader neoliberal shift in U.S. government policy—a transition marked by what she suggests is "an ideology of enlightened selfishness marshaled by a government catering to big business in the name of laissez-faire economics" (2013: 66). Coleman goes on to describe how this fortification of intellectual property law accompanied by the aggressive prosecution of violators is perceived by computer hackers as an assault on a cultural ethic which treats the freedom to share information, collaborate, and simply tinker with and improve the technologies encountered in one's environment as basic rights (2013: 3, 11, 39, 42, 68)—or what might also be described as moral absolutes which transcend the self-seeking, profit-driven mentality underlying strict forms of corporate ownership and control.

While Coleman makes the astute observation that the hacker ethic should not be treated as some homogenized code that is ubiquitous among computer hackers (Coleman, 2013: 19), she does call attention to several important themes which do appear consistently among hackers and F/OSS developers. Specifically, she refers to the way that code is conceived of as speech, and should therefore be protected by laws safeguarding freedom of expression (2013: 8-10, 161-184). Coleman also points to the manner in which

F/OSS represents the development of a working alternative to existing forms of intellectual property law, or what she refers to as a "rival liberal legal regime" (2013: 162). While these are certainly important themes connected to computer hacking and the development of F/OSS, Coleman attends only in passing, however, to the importance placed by computer hackers on physical community and face-to-face interaction.[7]

Also attending to the ongoing production of F/OSS, Kelty (2008) focuses more on the collective aspects of hacking and open-source software development. Specifically, Kelty describes what he refers to as a "recursive public" (2008: 3, 29, 43), or a public that "includes the activities of making, maintaining, and modifying software and networks, as well as the more conventional discourse that is thereby enabled" (2008: 29). He also calls attention to what he describes as the depth of these publics, or the "series of technical and legal layers—from applications to protocols to the physical infrastructures of waves and wires—that are the subject of this making, maintaining, and modifying" (2008: 29). Similar to Coleman, Kelty emphasizes the way that F/OSS is perceived as a form of self-expression (2008: 58), and the creation of a viable alternative to a presiding legal order which favors private ownership and the restriction of information (2008: 3, 150-151, 308-310).

Although touching on several important themes, Kelty's treatment of F/OSS developers as a recursive public leads to an over-determined interpretation which undermines the diverse practices and complex forms of collectivity evident among computer hackers involved in the ongoing production of F/OSS—or those who Kelty refers to simply as "geeks" (2008: 2, 29). In addition, although calling attention to the vital role played by a shared technological infrastructure in tying this broad community together, Kelty treats technology largely as a passive element—that is, something which is

expressed, modified, or acted upon. This overlooks the potential for a co-structuring form of production in which technology might shape and act upon the various forms of social interaction found within these largely informal groups of hackers and developers.

Moreover, while F/OSS development and computer hacking in general can certainly be treated as prominent forms of hacking, they are by no means the only forms of hacking found in hackerspace communities. At Noisebridge, for instance, hacking is often used to describe a broad range of productive interests ranging from science and engineering to cooking, music, arts and crafts, even kite making.[8] Hacking is therefore not a bounded activity limited to coding or computer software, but rather a way of approaching technology and production—and as previously suggested, perhaps even collectivity itself. Given the need for a more generalized notion of hacking this implies, activities associated with computer hacking and F/OSS may seem to be of only limited relevance to this discussion. As mentioned above, however, Coleman and Kelty each identify a number of important themes evident in the production of F/OSS and computer hacking that are also easily applicable to a broader range of activities and practices, and which will therefore be relied upon at various points throughout this paper.

In his work *A Hacker Manifesto* (2004), Wark provides a useful starting point for developing the generalized notion of hacking called for by the complexity encountered in the hackerspace. In particular, Wark describes hacking as a form of "free productivity, [and] an expression of the virtuality of nature" (2004: 195) which transcends any artificial barriers. Through the privatization and commodification of information, however, barriers of perception are continuously being created and recreated, thus creating an obstacle to the free combination of elements in the world (2004: 190, 195-197, 253) and hindering the

realization of a "limitless multiplicity of things" (2004: 152). For Wark, these barriers belong to the artificial realm of representation (2004: 222), an argument which he extends even to the perceived separation between subject and object (2004: 203, 222, 256). Hacking therefore constitutes a way of thinking and acting that refuses representation (2004: 222), and approaches reality through a liberated sense of perception—that is, an awareness of the artificiality of representation and information.

As illustrated above, Wark's conception of hacking transcends any mere notion of practice limited to computer technology. More importantly, Wark's narrative provides some sense of how hacking might be thought as an approach to collectivity and the social. In providing this much needed generalization of hacking, however, Wark relies heavily on neo-Marxist notions of class struggle and class consciousness. While he argues that social classes are themselves a result of representation and the artificial barriers arising from false notions of scarcity (2004: 187, 204-205, 256), Wark's depiction of distinct social classes undermines the potential for internal heterogeneity within these social classes—including what he treats as an emergent class of hackers (2004: 196). Moreover, Wark treats hackers and producers as distinct classes characterized by separate forms of production—or as Wark indicates, "[t]he hacker class virtualizes, the producing classes actualize" (2004: 344). This distinction between hackers and producers completely overlooks, however, those aspects of hacking which are inherently productive, as well as the extensive social and practical diversity evident among hackerspace communities such as Noisebridge.

In a similar vain, Wark also relies on an over-determined conception of virtuality in his suggestion that hacking constitutes a rejection of representation and the artificial

boundaries which constitute it (2004: 222). This overlooks, however, the manner in which certain barriers are not only maintained, but defended—as in the apparent cultivation of complex moral systems among computer hackers (Kelty, 2008: 27, 35; Coleman, 2013: 19, 182; O'Neil: 3-4, 69, 179). In the case of Noisebridge, this is illustrated by the balancing of an anarchic ideal against an absolute moral principle of excellence;[9] thus allowing the community to maintain some semblance of order as it negotiates a plurality of individual ideals, principles, and beliefs. This emphasis on virtuality also overlooks the persistence of material boundaries, which in turn highlight the persistent separations that exist between subjective and objective realities. While one might argue, to use a rather obvious example, that everything is made of the same subatomic particles, and that there is nothing inherently separating the various objects found in the material environment, this would be ignoring the durable stability exhibited by certain material forms. In other words, while the boundaries described by Wark may not be absolute, there are nonetheless material differences characterized by varying degrees of stability that must be taken into account in exploring the everyday practices encountered in the hackerspace. In spite of this over-determined virtuality, however, Wark's generalized conception of hacking as a form of free combination is of considerable use in understanding the manner in which technology and production are approached by those involved in hackerspace communities. Moreover, it also allows for a broader notion of hacking which might then be applied to the social, and the various other elements constituting the form of collectivity found in the hackerspace.

Although not dealing directly with notions of hacking, Gandy (2005) and Sheller (2004) introduce metaphors which offer the potential to think collectivity in terms of technology and the social. In the case of Gandy, the metaphor of the cyborg is used to

explore the blurring of social, material, and technological realities in the contemporary urban environment (2005: 28, 36-38, 41-42). Sheller, on the other hand, focuses on the spatial and temporal integration afforded by advances in transportation and communications technologies (2004: 42), thus enabling the formation of "a new kind of public-private, [and] a kind of fluid social space in which communication occurs which spans absence and presence, personal and impersonal, micro and macro, local and global" (2004: 47). These metaphors are useful for considering the various ways that technology allows for connections that transcend time and space, as well as other material boundaries. Sheller's notion of "intermodality" (2004: 43), which she describes as a shifting between public and private modes of action and interaction, is also useful in that it reflects the considerable complexity apparent in the largely informal interactions and practices encountered at Noisebridge. It is also useful in addressing the manner in which the hackerspace does not give rise to a singular form of organization or collectivity, but is rather an open infrastructure for a seemingly endless array of possible collective forms which can change from one moment to the next.

Similar to Wark, however, the metaphors introduced by Gandy and Sheller rely on an exaggerated sense of instability and virtuality, as well as the breakdown of persistent material barriers. In Gandy's notion of the urban cyborg, even the separation between biological and material realities is broken down through the integration of human beings into the materiality of urban infrastructures (2005: 28). This overlooks, however, the fact that the connections established between the human and the material, and between the human and the technological are in many cases fragile, ephemeral interactions connected to specific points in time and space. As previously emphasized, hackerspaces are not

bounded, self-contained communities which encompass all aspects of daily life. They are rather open, permeable communities formed by individuals who are constantly coming and going, with a multitude of connections that extend out into a broader social fabric—itself a shifting landscape of forms with varying degrees of stability.

While both Sheller and Gandy are critical of a network approach (Gandy, 2005: 35-36; Sheller, 2004: 39-41, 49), Latour's work offers what is perhaps a more tangible way of attending to the various forms of collectivity constituted by technological, material, spatial, and social components. For Latour, what is important is not a consideration of the subjective and objective aspects of existence (2005: 75), but rather a redefinition of what it means to be a social actor (2005: 75). In particular, Latour conceives of social actors as mediators (2005: 38-39, 128), or entities which embody a multiplicity of agencies and connections (2005: 50, 54, 60), and whose actions are therefore characterized by varying degrees of uncertainty (2005: 60). This conception of social actors is not limited to human beings, however. To the contrary, Latour suggests that most connections are in fact not of the human-to-human variety (2005: 75), and contends that the social should be expanded to include nonhuman social actors (2005: 70-74). In this expanded notion of the social—or what Latour refers to as "collectivity" (2005: 75) in order to avoid any over-privileging of human-to-human interaction—objects carry their own sets of agencies and connections. Like humans, objects cannot be considered merely as passive elements of collectivity, but are rather active participants in a vast web of human and nonhuman interaction.

It is not difficult at this point to see how Latour's conception of objects as social actors might be extended to encompass technological objects and practices, and any nonhuman aspect or component of collective existence. An especially clear example of this

can be found in computer technology, which through the act of programming is instilled with the processes and protocols developed by the programmer. It is not merely the computer, however, that is acted upon. The programmer is also acted upon and shaped by the computer—both physically in terms of its effects on the human body[10] (Levy, 1984: 24; Coleman, 2013: 13), and mentally as the programmer's thinking is shaped through the educative process of coding and producing.[11] This in turn points to a co-structuring process of technological production in which barriers, far from being obliterated through an over-determined sense of the virtual, are maintained as the very basis of production—or in the words of Latour, "an action that collects different types of forces woven together because they are different" (2005: 74-75). In the case of hacking, it is apparent that the very act of free combination, although sometimes involving a redefinition of existing representational boundaries, nonetheless relies on the persistent existence of tangible differences.

Latour also calls attention to the inherent instability of social ties, and the manner in which groups exist only in a constant state of formation and reformation (2005: 28, 36, 66). Although less fluid than Sheller's social gels (2004: 41, 46-49), Latour's notion of instability allows for a conception of shifting modalities that is vital to understanding the manner in which hackerspaces do not imply a singular social identity, form of interaction, or set of social and productive practices for those involved. Hackerspaces are instead formed by individuals who regularly shift between different social groups, and even between multiple modalities within the hackerspace community itself.[12] Hacking for these individuals no doubt constitutes a way of thinking that is retained and therefore shapes activity and interaction beyond the walls of the hackerspace, but there also forms of practice and social interaction which are very much tied to the physical context of the space. In this sense,

Latour's conception of instability is useful in that it allows for shifting modalities while also paying heed to material separations.

Sheller criticizes this aspect of network theory as "overly rigid" (2004: 49), and while a metaphor consisting of gels and fluids is indeed useful for attending to the unstable, artificial distinctions characterizing various social and political forms of interaction, it is insufficient for exploring the more material aspects of hackerspace collectivity. In other words, relying on a metaphor based entirely upon notions of fluidity and instability is just as much "throwing in the towel" (so to speak) on mapping complexity as is a metaphor rooted in over-determined notions of stable social forms and connections. A fine balance must therefore be struck which pays heed to the manner in which hackerspace collectivity is constituted by elements and connections that are neither fluid nor rigid, stable nor unstable, but are instead characterized by varying degrees of social and material durability.

Time Warps, Space Stations, and the European Model

Among the various communities that were described during the hacker conferences held in Germany in 2006 and 2007 was "c-base"—a Berlin hackerspace that had already been in existence for more than a decade.[13] Although physical spaces (sometimes referred to as "hacker labs" or "hacklabs") had been in use by hacker communities for quite some time,[14] the model for the contemporary hackerspace attended to in this paper (of which c-base is perhaps the earliest example) represents something of a departure from previous forms. In particular, c-base was founded by a small group of individuals who did not necessarily see themselves as computer hackers. In fact, the space had initially been intended as a kind of science-fiction fan club, oriented around the ongoing creation of a

collective myth involving the supposed discovery of a crashed space station underneath Berlin—a discovery which, according to the group, had previously been known only to East German and Soviet government authorities. As the legend goes, this large, multi-purpose space station allegedly time warped into the past from some unspecified future date and after experiencing a malfunction, crashed to earth and became buried beneath the site of what would eventually become the modern city of Berlin. The space station is described as having consisted of seven concentric rings, with each one serving some infrastructural, technological, or socio-cultural purpose. The group even went so far as to incorporate the *Fernsehturm* television tower into the legend, suggesting that this icon of Cold War era east Berlin is in fact the space station's communications tower, still protruding from the ground near *Alexanderplatz* square.

At the time of its conception, c-base was intended as a place where members could gather and socialize based on a shared interest in science fiction and technology, partially expressed through the ongoing generation of a collective myth. This legend, or what the community refers to as the "c-base project," is described as the excavation and restoration of the c-base space station including its technology, culture, and distinct form of social organization. Founded in 1995, the original space[15] consisted largely of a living area and kitchen—a room that was subsequently converted into a high-tech "space kitchen"—and was used by the group to host frequent informal gatherings and parties. Soon after it was established, word of the space began to spread through local networks of geeks, computer hackers, and digital activists who came to embrace the myth of the space station and became active in the ongoing development of the community that was forming around the c-base project.

By the time they were discussed at the Chaos Communication Camp in 2007, c-base and a handful of other European hackerspaces inspired by it[16] had come to be perceived as models for the establishment of similar spaces and communities. The general blueprint arising from these early hackerspace, only loosely defined at the time, was largely a combination of design patterns, core values, and practical advice acquired through trial-and-error on how to best navigate the various challenges surrounding the establishment of a physical space.[17] Soon after this model was shared in 2006 and 2007, hackerspaces such as NYC Resistor in Brooklyn, Pumping Station One in Chicago, Noisebridge in San Francisco, and numerous other spaces in North America and in locations around the world began to appear. These spaces were not merely intended for use by computer hackers, however, but instead gave rise to groups which embraced various social and practical genres related to Do-It-Yourself (also known as DIY),[18] indie arts and crafts,[19] and a diverse array of individuals and groups drawn to the notion of democratic, non-hierarchical communities occupying autonomous spaces of interaction and production.

Since their emergence in the U.S., hackerspaces have multiplied into a diffuse network of communities which are exceedingly diverse and therefore exceedingly difficult to generalize. In the Bay Area of northern California, for instance, there are numerous examples of the practical, social, and cultural complexity of the hackerspace phenomenon. In addition to Noisebridge with its anarchic orientation and focus on computer and hardware hacking, there is also BioCurious which focuses on the informal advancement of biotechnology;[20] Mothership Hacker Moms established for mothers interested in hacking and self-determined production, which emphasizes informal education in the hackerspace and also provides childcare for those involved;[21] and Liberating Ourselves Locally (or LOL

as it is referred to by its members), a space founded by people of color and focused on creating a more balanced hackerspace community in terms of ethnicity and gender.[22] Surprisingly, these groups represent only a mere sample of the numerous hackerspaces and informal co-working spaces located in the Bay Area alone, and an even more minute sample of those now scattered across the country.

In spite of the considerable variation which exists across this broad network of communities, there do appear certain themes that can be observed with remarkable consistency. As alluded to above, these particular themes reflect a basic interest in hacking and self-determined production, a non-hierarchical form of democratic self-governance,[23] a fundamental commitment to personal freedom and self-determined production often referred to as "do-ocracy,"[24] and an emphasis on treating others, their projects, and the space itself with respect. There is also a consistent emphasis found in hackerspace communities on informal education, and an approach to learning that is inseparable from creative self-expression and the direct act of producing.[25] These rather basic generalizations should not be applied too strictly, however, in that the manner in which these principles and other ideals are negotiated in practice varies greatly from one group to another. It should also be pointed out that there is no central organization or sanctioning body for hackerspaces, reflecting the decentralized, non-hierarchical approach to organization found within hackerspace communities. As a result, many of the groups that are otherwise closely affiliated with the broad network of communities of which hackerspaces are part do not necessarily refer to themselves as hackerspaces or describe their activities and practices in terms of hacking.

This significant variation is apparent in a distinction that is sometimes made between hackerspaces and makerspaces, as well as between the hackers and makers who produce them. For many, these terms are largely interchangeable, and respondents were often unclear as to what difference (if any) existed between them. For others, however, these terms reflect an important ideological split that is evident in the fact that many communities identify themselves explicitly as makerspaces, or even co-working spaces, in spite of their apparent alignment with the hackerspace model or the extensive interaction that takes place between these communities and other groups identifying themselves more overtly as hackerspaces.

This split in terminology can be traced to a particular strand of DIY known as the Maker Movement, which has had considerable involvement in the creation of spaces reflecting the hackerspace model in the U.S. and elsewhere. The term Maker Movement stems from an online publication and forum for DIY enthusiasts known as MAKE Magazine which was created by Maker Media in 2005[26] and the Maker Faires it began hosting in 2006. In the years since, many communities have emerged that identify with notions of both making and hacking,[27] while other groups align more exclusively with terms such as makerspace and making.[28] Indeed, in makerspaces and the so-called Maker Movement in general, the influence of the hackerspace model is often downplayed or ignored completely. This is apparent in the for-profit, corporately owned and operated TechShop co-working spaces that have appeared in various locations around the U.S., as well as the present push to establish makerspaces in public libraries and schools.[29] Numerous corporations have also come to embrace makerspaces and the Maker Movement,[30] and funding for the creation of these spaces has even been furnished by the Defense Advanced Research

Projects Agency (DARPA) of the U.S. Department of Defense. A considerable emphasis on entrepreneurship can also be found in the Maker Movement,[31] pointing to an apparent compatibility with corporate interests and a for-profit approach to production.

For some of those involved in hackerspace communities, however, this particular orientation is problematic. At Noisebridge in particular, this direct affiliation with private interests and government authority is treated by some as a significant threat to openness and individual freedom, the sharing of information, and the preservation of free and independent forms of community. Moreover, government funding (especially that connected to defense spending) is also perceived by many as a source of support which comes with inevitable strings attached—or commitments which are, in the case of Noisebridge, deeply incompatible with ideals pertaining to anarchy and non-violence often expressed by those in the community.[32]

The manner in which some groups identify themselves exclusively as makerspaces also underscores the fact that hacking is a term which continues to be plagued by notions of illicit activity, and which can therefore be problematic from a political standpoint. This should not be taken to suggest, however, that the term hacking is absent from the interactions, viewpoints, and descriptions of practices and projects encountered in makerspace communities. It is rather to point out that in the context of makerspaces and the Maker Movement in general, hacking is downplayed to a certain extent, and is treated more as an aspect of innovation than a fundamental approach to technology and production by which individuals or communities might identify themselves. As mentioned above, however, there are many involved in hackerspace communities who perceive little difference between making and hacking, or between the Maker Movement and the

emergence of hackerspaces in general. This in turn highlights the fact that hackerspaces should not be treated as a distinct or bounded phenomenon, but rather as a diverse genre situated within a broad, unbounded network of communities oriented around similar interests, practices, and beliefs.

Noisebridge – Hacking Pattern

Noisebridge is located in the visual and socio-cultural frenzy that is the Mission District of San Francisco. It occupies the top floor of an unassuming three-story building that also houses an unmarked dry-cleaning facility and a small neighborhood grocery store called "Mi Ranchito." Next to the grocery store on the ground floor, which during the day is open to the sidewalk and lined with large bins of fruits and vegetables, is an inconspicuous iron gate barring the entrance to a stairwell. Were it not for the small black and red banner strung above it, the gate would appear not unlike any other in what has traditionally been a less-than-affluent, largely immigrant community. The banner conveys little in the way of information, however, and merely features a stylized depiction of a "noise bridge." This rather esoteric logo is described as "a piece of electronic test equipment that injects noise into a system to see how it responds, so you can fix or improve it"[33]— a telling metaphor for what goes on inside the space. Upon closer inspection, one might also notice the stripped-down body of an old payphone mounted to the gate, or what initially appears to be some forgotten relic from a bygone communications era. This old payphone box is far from abandoned, however, and functions as part of an intercom system, which is also complemented by a surveillance camera that streams live video to a large screen inside the

hackerspace—thus allowing those inside to screen potential visitors or anyone attempting to access the space without a key.[34]

Upon entering the 5,200 square feet of Noisebridge,[35] one encounters an almost overwhelming amount of clutter trailing from floor to ceiling, and in some cases even hanging from the ceiling itself. This clutter consists of a chaotic mélange of wires, pipes, posters, electronic equipment ranging from the state-of-the-art to the antique, bins of recycled parts, and an array of partially finished projects that defy any outside attempt at interpretation. Even in areas that are not overflowing with a mess of wire, plastic, and metal, there is very little space that goes unused. The walls are covered in posters, slogans, symbols, models from science-fiction films, mission statements, irreverent humor, photographs of people and events, art which often incorporates colorful LED lighting or other forms of electronic hardware, and even stories conveying some historical anecdote related to the history of computer technology. One is also confronted by the pervasive presence of electricity, and a multitude of machines and equipment hovering in a tentative state of standby. Lights blink, screens glow, machines hum—even during times of relative calm or *human* inactivity, the space is very much alive.

Although it can be easy to lose sight of this, Noisebridge is also very much a place of human interaction. This important social component, or what respondents often describe in terms of community, is a fundamental aspect of the collectivity encountered at Noisebridge. Before exploring the manner in which this collectivity can be thought in terms of a particular relation to technology, however, it is necessary to first provide some sense of the productive practices found at Noisebridge—thereby illustrating the manner in which hacking is approached by the community, and the relation to technology this implies.

While numerous projects are immediately visible to the naked eye, a great deal of the work performed at Noisebridge is rooted in a more virtual context. This refers to the considerable emphasis placed on computer programming and F/OSS development evident in the community, including participation in the ongoing development of the Linux and Debian operating systems, as well as the non-profit Mozilla project and its popular web browsing software. Although these certainly represent prominent examples of free or open-source software development, however, F/OSS should not be thought as a particular set of projects or programs. Rather, F/OSS constitutes an approach to creating software that involves sharing code and sourcing an open community of developers who in most cases are unpaid volunteers—or user-developers who exhibit both an affective and practical interest in the continued development of a collective project and a shared technological infrastructure.[36]

In the context of the hackerspace, F/OSS projects are not limited to virtual applications, however, but are oftentimes linked inextricably to objects in the material realm. Examples of this include the use of open-source software in robotics, electronics, music production, clothing wired with LED lights programmed to display a desired set of patterns, and practically anything that might conceivably be enhanced through a creative application of electronics and source code. In many cases, software provides an infrastructure for the weaving together of the virtual and the material, and allows for a programming of the physical environment. This can be as simple as the LED artwork scattered throughout the space, or as complex as the creation of robots and other "intelligent entities" (Levy, 1984: 140).

A particularly interesting example of this weaving together of the virtual and the material was described to me by Andrew Byrne, an individual involved in indie game development. After detailing several of his past projects—most of which conveyed a deep-rooted concern for social improvement—Byrne spoke of his current work on an augmented reality game for tablet computers. He described this game as a multiplayer first-person shooter that "injects" virtual zombies into one's actual surroundings using the tablet's built-in camera and positioning system. The goal of this game was to then kill these zombies—visible on the tablet's screen as it is held up against the user's field of vision—using an arsenal of virtual weaponry. To illustrate this, Byrne gestured at the street visible through the windows of the crowded café where we are seated, and described how a zombie might suddenly appear, walking down the sidewalk and visible to anyone with the game running on their tablet. As the term augmented reality suggests, this application goes far beyond mere notions of virtual reality, in that the virtual in this particular instance *is inserted into the real*, constituting an added layer of experience for multiple users. This in turn establishes a link between individuals that is rooted in the virtual, and yet constituted through blending of virtual and physical actions and experiences.

What was remarkable about this project, however, is not only the way that social, virtual, and material realities were being woven together through a novel application of technology, but also the manner in which this technology was being produced. In a reflection of the many shades of open-source technology that one can encounter in the hackerspace, the software plug-ins created by Byrne for running the game were being developed as "verticals"—or elements of the project that would be protected by intellectual property rights and sold to players once the game was ready for use—while the browser

created to support these plug-ins was being shared with a community of developers as F/OSS. In the case of the plug-ins, this involved obtaining a patent. Instead of implying a closing off or restricting of technology, however, Byrne went on to explain how filing a patent "lets you talk about [the project]…in a secure way." Resembling Coleman's identification of a "well-developed legal consciousness" (2013: 62) among computer hackers and F/OSS developers, the patent process in this instance was not described as a way of limiting access, but rather as an infrastructure for sharing ideas with a community motivated by a passion for creating technology and sharing information that transcends simple monetary incentives (Coleman 2013: 66, 185). While only the browser was being developed as F/OSS, Byrne's project involved an open-source orientation in which the community is informally "sourced" for its ideas and support—or what Byrne described as the "electric fusion" of people working together in an open environment.

Immediately after entering Noisebridge, one is likely to encounter another distinct example of a collective, informal approach to technological production. What initially appears to be a large electric wheelchair buried in a chaotic mesh of wires and electronics, is in fact a single iteration of an open-source robotics initiative known as the "DORA Project."[37] This robot, consider by its developers as a type of DoraBot,[38] is also affectionately referred to as "McHawking"—an oddly irreverent tribute to the well-known scholar and physicist. Although programmed to function under its own guidance, the robot also has a reputation for not being particularly discerning in its behavior. During one of my first visits to the hackerspace I was initially encouraged to "fire up" McHawking, but was then immediately cautioned that the robot is known to back people into corners and generally "chase people around" from time to time. As an apparent indication of this (and in

characteristically esoteric fashion), a sign was attached to the robot reading "WARNING: NOT THREE LAWS COMPLIANT"—a reference to the set of laws outlined by Isaac Asimov (1983) pertaining to the programming of robots, and introduced to prevent robots from harming their more fragile human counterparts.

This peculiar ambassador for the DORA Project is far more than a simple instance of hacker ingenuity and resourcefulness, however.[39] It also points to a distinct appreciation for the individuality of technological objects, and an ideal that old or worn out pieces of technology should not be thrown away, but rather revived and repurposed.[40] This in turn suggests a particular stance towards technological objects that involves a recovery of previously commodified forms. Through a direct repurposing of technologies and materials, prior commodities are imbued with the self-expression of the producer, achieved through the liberation, modification, and augmentation of the object's original design—or in a word, hacking. Through this repurposing and modification of design, a previously commodified form (such as a mass-produced electric wheelchair) takes on a distinct individuality which reflects a renewed intimacy between producer and produced. In the case of McHawking, this also points to the manner in which notions of subject and object become increasingly problematic. While a robot may be designed to perform some specific set of tasks, thus reflecting a certain level of instrumentality, one does not simply "use" a robot. One *interacts* with a robot.

In addition to McHawking, there are also numerous other examples of projects which seem to reflect a complete departure from the commodified form.[41] It cannot be said, however, that commodification is entirely absent from the hackerspace. Rather, what is found at Noisebridge is not so much a complete and categorical rejection of commodified

forms, but rather a diverse and complex array of productive practices, some of which involve drastically altered processes of development and production. In some of these practices, the commodified approach to production also undergoes significant transformation in that technological objects are not replicated only to be purchased and then "consumed" or "used up" by an end user. They are instead acquired as elements which might then be assembled according to pre-existing design patterns, or which might also be modified or completely repurposed by a user-producer of sorts. This points to the manner in which the commodified object is perceived not simply as a resource, but as an *iteration*, or a reference point in a recursive, collective process of use, reflection, and modification.

In his largely journalistic piece on the Maker Movement, Anderson (2012) attempts to outline this iterative process of collective development. In particular, he points to the manner in which intellectual property law is used not to prevent others from producing a patented product, but in many instances simply to protect the producer's trademark (Anderson, 2012: 114). While physical items are sometimes sold to those interested in simply purchasing a finished product, designs are also shared freely with anyone interested in acquiring the parts and producing the product for themselves—in addition to those who might otherwise be interested in modifying the design, or even transforming the product into something different (Anderson, 2012: 107-112, 115-118). Anderson suggests that this allows for a community of developers and user-producers to take shape (2012: 111-112)—in turn leading to a mutually beneficial relationship in which individuals are free to make and hack without restriction while the initial designer obtains free help in the ongoing development of the design (2012: 108).

This is, of course, a singular conception of a productive model which exhibits significant variation. Anderson does touch on something important, however, in that he identifies a productive approach which emphasizes autonomy, self-sufficiency, and the direct, self-determined creation and improvement of the objects that one uses and possesses. Although relying an over-determined interpretation which treats this productive approach as something of a revolutionary social and economic movement, these themes invoked by Anderson do reflect a general orientation in makerspace and hackerspace communities that is also readily apparent at Noisebridge.

Given Anderson's description outlined above, it is of little surprise that the approach to production encountered in makerspace and hackerspace communities is often described in terms of regaining access to the means of production (Anderson, 2012: 63-66) or Marxist notions of social and economic transformation.[42] This perhaps stems from the deeply personal, affectual aspects of hacking and the various forms of independent, self-determined production found in hackerspace communities which contrast sharply with more industrial forms of mass production. This in turn point to a productive intimacy and what could easily be interpreted as a potential reconciliation between laborer and product, or the absence of a classical Marxist notion of alienation.[43] Ultimately, however, a Marxist or neo-Marxist perspective relying on notions of class struggle overlooks the extensive diversity in terms of individual projects, interests, and motivations that is apparent in the hackerspace community, and will therefore not be discussed in any great detail here.

What these examples point to, therefore, is not a narrow set of social relations or motivations driving the practices found at Noisebridge, but rather a general relation to technology that is adapted to a variety of motivations and interests, and which is often

articulated by the community in terms of hacking and making. Evident in the projects mentioned above, there is also an apparent emphasis on raising design to a conscious level of awareness, thus making the patterns latent within a particular object or system accessible, and thereby allowing them to be reflected upon, reassembled, and modified. In the case of open-source technologies such as F/OSS, this process is performed collectively as designs are shared, modified, and communicated in a recursive process of development and production. Even in the context of this collectivized approach found at the hackerspace, however, the work of the individual remains key—in that work is often performed in social isolation, even when part of a broader technological and material discourse. This reflects what are also the competitive, meritocratic aspects of hacking described by Levy (1984: 30-31) and O'Neil (2009: 3-4, 179), and the manner in which technology is thought to embody the self-expression of the hacker.

To develop a better understanding of how the Noisebridge community approaches technology and hacking in general, it is helpful to consider the particular conception of hacking put forward by Wark (2004). As previously mentioned, Wark depicts hacking as a blending of elements and blurring of perceptual boundaries.[44] More specifically, Wark approaches hacking as a way of thinking, being, and acting which transcends the artificial boundaries imposed on the world by the expansion of an all-encompassing scheme of private property and commoditization (2004: 177, 195, 253). This process of privatization is not limited to material forms of reality, however, but also involves an "enclosure of the information commons" (2004: 197). For Wark, information and virtuality are inherent aspects of a single, all-encompassing environment (2004: 195), the elements of which can be combined in the realization of a "limitless multiplicity of things" (2004: 152). Hacking,

therefore, can be thought as a particular form of productive activity characterized by the uninhibited sharing of information and a free association of elements which transcends any notion of virtual and material, or subject and object (2004: 195, 203, 222, 256). As a result, the barriers imposed by the application of intellectual property laws results in a "fetter" (Wark, 2004: 195) upon the process of hacking, or what Coleman refers to as a "personal affront as well as a significant cultural threat" (2013: 68) to hackers.

By virtue of what Wark depicts as hacking's inherent opposition to the property form, it is not difficult to see how Wark extends this particular notion of hacking to encompass an emergent social class. As previously mentioned, however, clear class distinctions and notions of class conflict are insufficient for addressing the complexity found at Noisebridge, or in the hackerspace movement in general. More importantly, Wark's conception of hacking also falls short in that he relies upon a fundamental notion of reality that is lacking in any fixed boundaries or concrete distinctions. While this is useful as an *ideal type*, and a point of reference for understanding the general approach to technology that is evident in hacking, it overlooks the persistent barriers that undeniably exist. This is not to say, however, that all perceived barriers are necessarily permanent or indestructible. Indeed, many barriers that do exist are ethical in nature, reflecting a noticeable effort among hackers to develop clear moral codes and ethical standards.[45] While these values must certainly vary from one individual and from one group to the next, certain moral orientations—or what Coleman refers to as "moral genres" (2013: 19)—are clearly evident in hackerspace communities. In the case of Noisebridge, the negotiation of a moral code (albeit a minimal one) is visible in the articulation of the principle of excellence previously mentioned, which is invoked as something of a general ideal against which

behavior is compared and evaluated through open discussion and debate, and modified through changes made to the practices and processes negotiated by the community.[46]

There are also persistent barriers, both moral and material, between biological and technological realities. At Noisebridge for instance, a strong aversion to genetically modified foods was expressed in a variety of contexts, as well as a resistance to the use of chemical pesticides in dealing with a recurring cockroach problem at the hackerspace—thus reflecting a persistent commitment to the separation of biological and technological, organic and inorganic elements. These issues were openly debated, however, and artificial barriers were thereby negotiated collectively by the group through an often informal process of consensus and decision making—such as the eventual decision to use organic solutions for combating the presence of unwanted insects in the space.

These moral commitments can vary significantly, of course, from one community to another. During a short talk that was given at Noisebridge as part of a larger event,[47] an individual active in biotechnology hacking described the development of a device which uses light to control neural activity in rodents—or as it was described in the presentation, the creation of remote controlled mice.[48] In an apparent response to the projects mentioned during this presentation—another example being the development of genetically modified vegetables which glow in the dark[49]—one attendee questioned whether these activities might not spiral out of control, or as he put it, lead to "killer tomatoes running down the street." The viewpoint that was offered in response to this concern, however, was that biotechnology hacking plays an important role in bringing cutting-edge technologies out of the shadows of private labs, and into a public sphere

where they can be assessed more openly, debated, and ultimately regulated in a more democratic manner.

While these examples certainly represent a blurring—or rather an entangling, if you will—of biological and technological realities, they also point to the manner in which these barriers are negotiated and in some cases maintained through the existence of an ongoing open discourse. Although some of these boundaries may be ethical, and therefore artificial in nature, material boundaries certainly do exist. Even in the case of genetic engineering, there remains a clear separation between the organic and the inorganic, even if the biological is woven together with nonorganic materials through the application of some technological process.

How then, should hacking be thought in the context of the hackerspace? In spite of its apparent shortcomings, Wark's narrative provides us with a more generalized conception that is useful for approaching the manner in which hacking is extended to encompass a broad, arguably unlimited range of practical activities. Specifically, it provides us with a conception of hacking which goes far beyond the development of source code and electronics, and that instead points to a way of thinking, being, and acting in relation to the world and the elements which constitute one's environment.

Coleman cautions us, however, that the "hacker ethic should not be treated as a singular code formulated by some homogeneous group called hackers but instead as a composite of distinct yet connected moral genres" (2013: 19). In a similar fashion, hacking as a practical way of relating to and producing technology should not be approached as a homogenous form—a fact that is reflected in the diverse practices, interests, and motivations apparent in the Noisebridge community. In a general sense, what is being

hacked is not so much code or technology, but the *designs* and *patterns* through which the basic elements of a perceived reality are brought together in the creation of novel systems and objects. Hacking, therefore, is not the destruction or rejection of representation as Wark seems to suggest (2004: 222), but rather the hacking of representation *itself*, and the *attempted* realization and practical negotiation of a seemingly unlimited array of imagined possibilities.

This process of recombination also points to the important fact that hacking is fundamentally a process of production. Although hacking is often associated with the sometimes illicit activity of *breaking into* an object or system, this deconstructive aspect of hacking is merely a single productive step in which the elements of an object or system are revealed, and thereby made accessible to the hacker. As a result, hacking is also a process of discovery and learning which involves pushing the boundaries of nature's representation—or what might also be thought as the maximization of representational complexity. This does not refer to just any form of representation, however, but representation that *works*—that is, representation which leads to real and practical functionality. This is similar to Wark's conception of hacking as a realization of limitless possibilities (2004: 150, 152, 153-156), but it differs in the sense that representation is not treated here as a mere hindrance, or something that can simply be discarded in favor of a more direct relation to reality. Representation sits rather at the very heart of what hacking is, and how hacking approaches technology, society, and the world. The question remains, however, in what manner can hackerspace collectivity be thought in terms of the relation to technology found in the hackerspace, and the generalized notion of hacking it implies?

Wiki Communities

In considering how collectivity at Noisebridge might be thought as an extension of the relation to technology outlined above, it is helpful to introduce a metaphor that is not burdened by preexisting notions of computer technology and legality often associated with hacking. While it may seem like a rather obvious point, it is also important at this juncture to distinguish between metaphor and representation. Specifically, the metaphor suggested here is not intended to function as a true representation of a perceived hackerspace reality. It should rather be approached as a model, or a form of conceptual scaffolding which is inherently reductive, and yet useful for grasping at the manner in which complex elements come together in the particular form of collectivity found at Noisebridge. Moreover, it is also important to point out that the various elements alluded to throughout this paper—described using terms such as subject and object, biological and technological, virtual and material—are themselves artificial contrasts used to make sense of the complexities encountered in the context of the hackerspace, and human existence in general.

This is not to say, however, that stable differences do not exist in reality (as Wark seems to suggest). It is instead meant to illustrate the manner in which these elements do not represent distinct or bounded elements of reality, but rather artificial reference points on a continuous spectrum of existence. These points are separated by tangible distances, however—or what might be thought in terms of qualitative differences—which although continuous, constitute separations and distinctions of varying degrees of durability. That is, many of the separations and distinctions alluded to here constitute real, durable

differences in practice which must therefore be taken into account. In the case of social ties and social connections, there is arguably a significant degree of fragility and impermanence as Latour contends (2005: 28), but certain connections and artificial boundaries can also exhibit a great deal of durability—evident in the continued focus encountered at Noisebridge, for instance, on maintaining a clear moral ethic of mutual respect. In a more material sense, what has come before obviously cannot be disregarded in favor of some over-determined conception of virtuality. Atoms bundled in the form of a mouse or a circuit in the present moment, barring the total destruction of these objects, are likely to continue in the form of a mouse or a circuit in the next—even if the two are joined in some strange or unexpected way.

In choosing a metaphor that is appropriate for the hackerspace, it is important to select one which allows for a blending of subjective and objective, social and technological, virtual and material, while also attending to the durable separations that exist between these various elements. In the notion of *wiki community*, we perhaps find such a metaphor. In sketching an outline of this metaphor, however, it is important to first clarify what is meant by the term wiki. Specifically, wiki is used here largely in reference to the Wiki website created by Ward Cunningham—the first example of a wiki[50]—and not to more recent instantiations inspired by Cunningham's model such as the rather obvious and immensely popular Wikipedia.[51] Moreover, while online wikis are used extensively in hackerspace communities—including one that is produced and maintained by Noisebridge—an external example is used here to avoid any potential confusion.[52]

First released in 1995, Wiki was created as an open-infrastructure website in support of "People Projects And Patterns"[53]—a project which Cunningham started as an

effort to trace "the way programming ideas are carried by people as they move between projects."[54] Over the years, Wiki has developed into a vast web of online pages which can be created, modified, and even deleted by anyone accessing the site. In addition, the organization of these pages can also be modified in that pages are woven together through a tangled web of embedded hyperlinks which can in turn be edited—thereby altering Wiki's basic structure. By changing the manner in which pages are linked together, editing hyperlinks shapes the way that users move through the website, encounter information, and ultimately interact through the ongoing production of the website.

As an open infrastructure, Wiki can be accessed and modified by anyone. Wiki is also open in the sense that hyperlinks sometimes link to external websites—thereby integrating the content found on Wiki into a broader network of information, expression, and virtual interaction. In spite of this open stance, however, the content of Wiki exhibits a distinctly inward orientation. Indeed, as one moves through Wiki, the website seems to expand incrementally into an endless network of pages, in turn connected by a seemingly endless array of hyperlinks which often twist and double back on themselves to previously visited locations. As a website without any clear informational hierarchy, Wiki also lacks any true "center," and navigation of the website can therefore be quite disorienting at times. Moreover, in the same sense that Wiki has no distinct center, it is also without any clear boundary, in that the hyperlinks which connect the pages of the website constitute a tangled mesh which circles and loops back on itself in an endless circuit—in turn suggesting a practically limitless number of potential paths by which to navigate the site.

This in turn points to the recursivity and reflexivity apparent in Wiki, in that content is formed through a continuous process of reflection, modification, and enhancement in

response to Wiki's content, or even in response to the infrastructure of the website itself. Wiki, therefore, is not so much added to as it is *grown*. This also illustrates the manner in which Wiki embodies the self-expression of its contributors—and yet, it is not merely a vessel for receiving individual expression. Self-expression of individuals is rather shaped by Wiki's infrastructural properties—including those which are consciously perceived, as well as those which are encountered practically through interaction—in such a way that self-expression *can* be captured by the website, itself programmed to actively communicate with the contributor through a simple interface.[55] Comments and pages, which often arise in response to the existing content of the website, then merge with the collective embodiment of the expressions of an community of contributors.

In the form of the wiki, self-expression is then encountered, reflected upon, and modified by other individuals in the community. As a result, Wiki cannot be thought as a mere aggregation of isolated threads of self-expression. It must rather be treated as an infrastructure which possesses its *own expressivity*, albeit one that is inseparably connected to the "traces left behind" (Latour, 2005: 29) by individual contributors. Wiki thereby plays an inseparable role in its own creation, and cannot be treated as merely a passive element in a broader collectivity.[56] Reflecting what Coleman identifies as the conception of code as a form of speech apparent among F/OSS developers (2013: 8-10, 161-184)—code that is itself a virtual technological infrastructure—the content found on Wiki can be thought to constitute a collective discourse which is embodied in the website, and yet one in which the website is itself an interlocutor which "speaks," and is then reflected upon and responded to by those who contribute to it. This is not intended to suggest some over-determined notion of technological anthropomorphism, but rather to un-privilege certain forms of

interaction as necessarily human. In other words, this description is meant to illustrate the manner in which a wiki—though obviously distinct from the human beings who use and produce it—is nonetheless an active participant in the recursive dance through which it captures and retains the self-expression of those involved in its ongoing creation.

It must be pointed out, however, that the social sustainability of this collective project is conditioned upon a practical ethic of trust and mutual respect,[57] made necessary by the open, non-hierarchical design of the site's infrastructure—and which must in turn be continuously negotiated and upheld by an open community of contributors.[58] As in the context of the hackerspace, although users might be banned in some rare instances, order is typically maintained through an informal process of collective and informal self-regulation—in which behavior is discussed, debated, and assessed against certain ethical standards which are necessarily basic in that they reflect an ideal of expressive freedom, and as a result, a vast plurality of opinions and beliefs.

In translating this open-infrastructure website into a metaphor for collectivity, it is helpful to think the Wiki infrastructure as a pattern. In spite of its openness and modifiability, however, it cannot be said that Wiki is entirely open, or that its pattern is entirely accessible to those who contribute to it. That is to say, representation does exist in that a typical contributor does not interact directly with lines of source code in editing or creating the website. Instead, individuals interact with an interface, or an important layer of representation designed to make the wiki accessible to those with little or no experience in the creation of websites.[59] By virtue of this interface, the infrastructure of the website is laid partially bare to the user who can then modify, create, delete, and rearrange content and pages in a seemingly endless array of possible combinations—albeit at a level of

complexity that is *predetermined* by Wiki's programming. As mentioned above, sustaining this practice of free production and the recombination of the basic elements of the Wiki environment depends upon the continued orientation of the community towards basic principles of openness, trust, and mutual respect—or a moral order that is not only *embedded* in the design of the technological infrastructure created by Cunningham, but also reflected upon and enacted by a community of users and contributors. This does not mean, of course, that pages cannot be appropriated from the community for personal use,[60] or that some pages and even groups of pages do not sometimes exist in a state of relative disjuncture from the rest of the wiki.[61] As one contributor aptly points out, however, "a wiki has no walls unless you made them."[62]

In this conception of Wiki as a pattern for collectivity, the manner in which the hackerspace community might be thought in terms of a wiki begins to take shape. As Latour points out, the social does not exist in a vacuum, and is not composed merely of subject-to-subject interactions (2005: 70-74). The social—narrowly defined here as direct or overt forms of subject-to-subject interaction[63]—is rather a mere aspect of collective existence, in turn constituted by an interwoven mesh of human and nonhuman elements and the interactions which "zigzag" (Latour, 2005: 75) between them. In the case of Noisebridge, collectivity is constituted by a complex web of human and nonhuman interactions, and elements exhibiting both subjective and objective, virtual and material aspects which are woven together spatially and temporally by connections exhibiting varying degrees of durability.

This collective form does not exist merely in the context of physical space, however, but is also constituted through the online interactions of the group—especially the

extensive sharing of information, interaction, humor, discussion, and often heated debate that can be found in Noisebridge's e-mail discussion forums. Interaction is also evident in the community's use of an online wiki. Like the e-mail discussion forum, interactions on the wiki are sometimes overt and clearly recognizable as such, but they can also be far more subtle and indirect—constituted through the collective, ongoing production of a shared technological infrastructure that exhibits its own expressivity, and thereby plays an integral role in collectivity.

Thought as an expressive infrastructure, this particular conception of the wiki can easily be applied to the material production of the space, as well as the technologies and technological practices which constitute an integral aspect of its ongoing production. As in the case of a wiki, material space at Noisebridge is approached as an open, modifiable infrastructure. Individuals are encouraged to make changes to the space—albeit after obtaining someone else's opinion if the change seems to be major or especially difficult to undo—reflecting the community's adherence to a notion of do-ocracy and an anarchic ideal of individual freedom. The form of anarchy expressed by many in the Noisebridge community is, however, not necessarily one of disorder and chaos. Similar to Bakunin's vision of anarchism—namely, one in which personal liberty is qualified by a moral code of respect and charity articulated in terms of duty and virtue (1971: 76)—the form of anarchism found at Noisebridge is one that is rooted in a notion of individual freedom moderated by principles of mutual respect and the excellent treatment of others, their projects, and the space itself; as well as an emphasis on making tangible contributions to the space, the community, and its practices.[64, 65] Similar to Wiki, this moral order is necessarily basic, however, in that is constituted through the collective negotiation of a

diverse array of interests, opinions, and beliefs upheld by the community's commitment to personal liberty and freedom of expression.

As previously mentioned, a wiki allows for the spatial and temporal integration of a diffuse community, in that it is constituted by interactions that span minutes, days, even years, and can involve individuals who are separated by vast distances. At Noisebridge, spatial and temporal integration is achieved in a variety of complex ways. As already pointed out, Noisebridge does not represent a closed community. In the manner outlined by Maffesoli in his conception of neo-tribes (1996: 76), Noisebridge is a community produced by individuals who are constantly coming and going, switching between a multitude of places and social groups that exist beyond the apparent confines of the hackerspace. Latour also calls attention to this social instability, and the manner in which "[r]elating to one group or another is an on-going process made up of uncertain, fragile, controversial, and ever-shifting ties" (2005: 28). In a more literal sense, individuals do not live at Noisebridge. They spend periods of time at Noisebridge, establishing connections through production and interaction with persons, objects, and technologies, and yet invariably, these individuals leave, and establish or reconstitute connections with other groups, other places, and other forms of collectivity. The individuals who constitute the human and social elements of the hackerspace community are therefore a diffuse group, scattered spatially and temporally, in that their time in the space does not necessarily coincide with the presence of other individuals involved in the community. As a result, although it may seem to be a rather obvious point, the space itself lends spatial integration to a community which is not at all confined to the physical boundaries of the hackerspace.

Noisebridge is rather a focal point of interaction—and an important one at that, given the events, interactions, and productive practices which it facilitates and is itself a part.

The connections engendered in the hackerspace go far beyond overt forms of social interaction, however, or the mere convergence of individuals in time and space. Reflecting the observation made by Coleman regarding the conception of code as speech (2013: 8), Kelty interprets this emphasis among F/OSS developers as "argument-by-technology" (2008: 58), in turn reflecting a notion that the objects and forms produced through material and technological production are themselves embodiments of self-expression. This notion evident among F/OSS programmers is far more than mere perception, however—it is a realization of what Latour describes as the manner in which objects are infused with human agency through a co-structuring process of interaction (2005: 59-60; 70-74). This is not to say that objects are a perfect embodiment of human activity and expression, but rather that objects, like humans, embody a multiplicity of agencies, extending like currents through time and space, and transcending the actions or existence of any single object or human being (2005: 166). In this sense, as in the manner already illustrated with an online wiki, the physical infrastructure of the space *acquires* "traces" (Latour, 2005: 29) of the interactions, activities, and objects produced by those present in the space—and as a result, the desires, motivations, and even the very thinking of those involved in the Noisebridge community. In the same manner that an online wiki develops its own expressivity, the material space at Noisebridge constitutes a partial embodiment of collectivity that is inseparable from those who are, or ever have been involved in the hackerspace—regardless of how separated they may be in terms of physical distance at any given point in time. In the case of Noisebridge's online wiki, e-mail discussion forum, and

various other sites of virtual interaction, the community is extended to an even greater extent to encompass individuals who only have an intermittent presence in the space, and even those who may have never had any direct physical contact with it.

This also highlights how Noisebridge is connected through the use of communications technologies to a broader network of hackerspaces, as well as a diverse and constantly shifting fabric of other interested groups and individuals. The manner in which these numerous communities and individuals are woven into a broader social and technological collectivity also calls attention to the fundamental openness of the hackerspace. Noisebridge cannot not be thought, however, as a mere point or "figuration" (Latour, 2005: 53)—that is, an artificial line traced around a confluence of connections and agencies in order to delineate a particular social actor—situated in a larger network consisting entirely of connections, interactions, and agencies. The manner in which connections and physical objects are gathered and bundled in the relatively stable boundaries of Noisebridge's physical space must also be taken into consideration. It cannot be said, of course, that individuals—who exhibit a *biological materiality*—do not come and go from the space, or that the space does not extend into the "invisible dimensions" (Gandy, 2004: 373) of material urban and technological infrastructures. Permeability does not necessarily imply fluidity or ephemerality, however. There is rather an undeniable materiality to the barriers separating the performative sphere of the hackerspace from what lies beyond. Moreover, this is not merely an unintended barrier, but one that is also maintained as a necessary layer of security.[66] As mentioned above, these relatively stable spatial boundaries should not be confused, however, with Noisebridge's social, material, and technological permeability—evident in the community's open stance towards

outsiders, the manner in which it is formed by individuals who are constantly coming and going, and the virtual interactions that constitute an extension of the broader collectivity of which the physical space is a part.[67]

In slightly different terms, the physical space of Noisebridge is an open yet finite space, containing social, material, and technological connections—or hyperlinks, if you will—which are both spatial and temporal, and which extend far beyond the physical confines of the space. As Latour points out, these connections are not fixed or concrete links between social actors (2005: 28). This does not mean, however, that they are inherently ephemeral or fluid as Sheller suggests in her conception of gelatinous sociality (2005: 47). They are rather characterized by significantly varying degrees of social, material, and temporal durability, thus constituting a broader social and collective fabric that is constantly forming, disintegrating, shifting and evolving.

As in the case of a wiki, Noisebridge also displays a distinctly inward focus. In his work on F/OSS, Kelty refers to the community involved in its ongoing production as a "recursive public" (2008: 3), thus highlighting the intense focus on "making, maintaining, and modifying" (2008: 29) the very infrastructure through which these individuals "meet, assemble, [and] collaborate" (2008: 43). It is not my intention to impose a public interpretation on hackerspace communities, but Kelty does call important to an inward orientation that is also clearly evident in the hackerspace. Unlike Kelty's recursive publics, however, the recursivity and reflexivity exhibited in the hackerspace extends far beyond a mere relationship to material and technological infrastructure—it is rather an inward focus which encompasses *all aspects* of collectivity, including a considerable emphasis on reflecting upon and shaping the social elements of the community.[68] At Noisebridge, this is

evident in the extensive amount of discussion that occurs in relation to the interactions, policies, and general norms that are continuously negotiated by the group. This inward orientation and emphasis placed on reflecting upon, dissecting, and ultimately tinkering with the social interactions and practices of the community—that is, the hacking of the social—is a practice that is readily observed in online wikis, and which constitutes a fundamental aspect of hackerspace collectivity.

There is no such thing, however, as a perfect metaphor. Thinking Noisebridge as a wiki community requires that its material infrastructure embody the collective self-expression of those active in the space, thereby taking on an expressivity all its own. The question must be asked though, in precisely what manner is self-expression acquired by the hackerspace? This is perhaps easy to envision in the online interactions captured by Noisebridge's e-mail discussion forum and online wiki, or in the ongoing projects and tangible physical objects encountered in the space, but this notion of "capture" becomes problematic in the context of face-to-face interaction. While the material aspects of the space may be modified through productive and technological practice—both those performed in direct relation to the physical infrastructure of the space, as well as those resulting in projects and technological objects which exist within the space—it cannot in any way be said that all social interaction is captured in the materiality of the space.

In the case of an online wiki, social interaction exists *solely* in the content of the wiki, and therefore interaction can be thought as fully—if only momentarily—captured by the technological infrastructure of the website. Similar to that found in the context of F/OSS, there is a considerable emphasis placed on material and practical forms of self-expression in the hackerspace. It would be incorrect, however, to suggest that face-to-face interaction

is a peripheral element of hackerspace collectivity. To the contrary, face-to-face interaction and a desire to be in the physical presence of a like-minded community of individuals figures prominently in the motivations expressed by respondents for becoming involved in the hackerspace. Moreover, while there is a significant emphasis placed on capturing the social interactions which occur during meetings and events—evident in the extensive and open archive of meeting minutes, e-mail discussion threads, photographs, and videos which can be found in the Noisebridge wiki—not all social interaction is captured, and therefore represented in a form which can then be reflected upon by the community. The question which might then be stated in response to this metaphor of wiki community is, quite simply, "where is the social?" The notion of a wiki also conveys a certain simplicity which, although it might useful for the sake of conceptualization, does not adequately reflect the complexity of elements constituting hackerspace collectivity.

The notion of wiki community remains useful, however, even if only as a starting point for understanding the forms of collectivity encountered in hackerspace communities such as Noisebridge. Indeed, the conception of a wiki community is not intended to be a final metaphor for hackerspaces. It is rather a basic tool for approaching what I perceive to be a number of recurrent themes encountered in the context of these communities. In slightly different terms, it is intended merely as a single step towards mapping the complexity of these novel forms of social, material, and technological collectivity.

Conclusion

Hackerspaces are complex social, spatial, and technological communities that resist simple interpretations. For this reason, they are also fascinating to study from a social

science perspective. Researching hackerspaces involves navigating a considerable amount of diversity, and is a pursuit that is filled with a countless string of memorable personal and technological encounters. Moreover, in addition to the many terms which might be used to characterize hackerspaces, they are also very much imaginative spaces—something which became evident during my research when I learned about the practice of world building.

When it was first mentioned to me, this term conjured up notions of the virtual environments created for computer games or in the development of expansive online worlds such as that found in Second Life.[69] It soon became clear, however, that the work described to me by an individual involved in this particular activity at Noisebridge reflected a vision that extended far beyond the virtual. Although he alluded to several projects done for small game companies in the past, the project he seemed most excited about was his ongoing work related to a virtual world of his own creation, complete with its own intelligent beings and social forms, and situated in a virtual universe with distinct scientific laws and physical properties. The conception of this world did not occur in a vacuum, however, and he described to me the considerable research that had been required to establish a coherent and believable virtual realm, especially with respect to art and architecture, history, science, religion, and even politics. In describing this research to me, it became apparent that the learning associated with world building was in fact an important motivation and source of enjoyment associated with this particular pursuit.

In a rather unexpected turn, however, our conversation regarding an extraordinarily detailed series of architectural designs which he had brought up on his personal laptop transitioned seamlessly to his description of what appeared to be a large communal structure of some kind. As we continued to talk, he proceeded to escort me

through a virtual complex consisting of a circular arrangement of units intended for sleeping, working, and socializing, along with areas for growing and preparing food, and even an all-faiths temple of sorts. The plans also included an extensive material and technological infrastructure designed to facilitate the long-term habitation of the complex. At first, the conversation was somewhat bewildering as he maneuvered seamlessly between descriptions of a virtual world obviously situated in a nonexistent universe, and a communal form that in all respects appeared to belong to a distinctly human reality. I questioned him about this communal structure, and learned that it was in fact a design he was working on for an actual *hacker village*.

Although resembling the general model alluded to in this paper, the hacker village involved extending the model of the hackerspace to encompass an entirely self-sufficient, lived-in form of collectivity. Constituting a drastic departure from the practical rule found at Noisebridge against sleeping overnight in the space, this communal design was intended to function as an independent form of collectivity in which the infrastructure and physical pattern of the complex embodied the principles and ideals of the community—especially evident in the recursive modularity and non-hierarchical layout of the village.[70] This design, although not yet realized in practice, was nonetheless a remarkable vision of a more developed and autonomous form of hacker collectivity.

In spite of the obvious logistical, financial, and even legal challenges facing the realization of such a design, the notion of a lived-in, self-sufficient, and *complete* hacker community is not an isolated vision. This is evident in discussions at Noisebridge regarding the potential addition of sleeping pods to the space, and ongoing efforts to construct a more complete, self-sustaining, and partially habitable hackerspace in the middle of Brooklyn

known as "hackert0wn."[71] It is also reflected in the notion of a total society apparent in the myth of the c-base space station. This conception of a complete society existing within a futuristic space station is more than just a myth, however, it is also a *model* on which c-base continues to evolve. As I have emphasized throughout this paper, the heterogeneity evident within hackerspace communities cannot be overlooked. The examples provided here do point, however, to a recurring theme encountered at Noisebridge and one that is remarkably consistent among hackerspace communities in general. Specifically, when a broader social vision is articulated, it tends to reflect a distinct orientation towards the creation of *alternative societies* within a broader social context, and not the revolutionary transformation of society as a whole.[72]

This does not mean, of course, that a liberal commitment to broader social improvement is absent from these communities. Indeed, an emphasis on the betterment of society is often apparent in the projects and opinions encountered at Noisebridge. This commitment to social improvement tends to be negotiated, however, through the creation of what Coleman describes as "a living counterexample" (2013: 185). It also reflects the emphasis identified by Kelty on "argument-by-technology" (2008: 58), and what Coleman suggests is a perception among computer hackers that "[s]ometimes language alone is not capable of inspiring action, and, under certain historical conditions…is often *robbed* of the potential it holds to imagine alternative realities" (2013: 204). At Noisebridge, this emphasis on creating a practical social alternative reflects what might also be thought as an "intuitive liberal anarchism" (McKay, 1998: 3), or the combination of a deep-rooted concern for social improvement and an anarchic ideal of personal freedom. In fact, when

asked whether hackerspaces might serve as a more general model for widespread social change, respondents were often ambivalent or rejected this idea altogether.

This is understandable given that revolutionary social transformation implies the imposition of a new social order on society, and is therefore perceived by many as contradictory to an anarchic ideal of personal liberty. The orientation often encountered at Noisebridge is instead one of iterative social improvement, and the development of tangible, functioning alternatives to existing social practices—or irrefutable proof of a better way of living and being in the world. This in turn illustrates how political action is approached in the context of the hackerspace. In thinking hackerspace communities as alternative societies, distinct notions of public and private, political and social must necessarily be reexamined. Reflecting Sheller's conception of "liquid sociality" (2004: 47), these artificial notions of human activity and interaction no longer seem to constitute distinct realities in the hackerspace, but are rather *aspects* of interaction and collectivity that never quiet exist in a self-sustaining form. In the case of political action, there are certainly those involved in Noisebridge who pursue larger social and political projects, including those actively involved in the continuation of Occupy San Francisco, but much greater emphasis is placed on the development of the hackerspace community. When political and legal expression does become apparent, it is more often a tactical defense of the projects and productive freedoms of those involved in the community. This is, of course, a grossly over-determined conception of a collective orientation, which is no way articulated by the community as a whole. It is rather a reflection of what can only be described as a recurrent theme arising from a plurality of voices, which is also apparent in the practices and interactions of the community.

At the time of this paper, the future of Noisebridge appears uncertain. The financial challenges associated with operating a hackerspace raise significant doubts as to whether the community will be able to continue in its present form. In a much broader sense, however, what is perhaps the greatest challenge facing the hacker approach to collectivity is not the financial sustainability of physical spaces. It is rather the very aspects of hacking which Wark uses to describe its social and political potential—namely, the transcendence of artificial barriers, and the realization of limitless possibilities through "an expression of the virtuality of nature" (2004: 195). Although Wark's conception of hacking overlooks the persistent barriers present in the material environment, as well as those that are collectively maintained such as the moral codes and ethical systems evident in hackerspace communities, it does nonetheless point to the fundamental virtuality of the social. While this may suggest the potential for a vast array of emergent social and collective forms—as well as the considerable potential for social improvement this implies—it also reflects a way of being and relating to the world that is fraught with moral, legal, and normative challenges. This is clearly evident in the connection that continues to be made between hacking and notions of illegality in the mainstream media. It is also apparent, on the other hand, in the considerable emphasis placed by hacker on developing strong ethical standards, and the cultivation of what Coleman describe as a "well-developed legal consciousness" (2013: 62). As Wark suggests, hacking's greatest potential may indeed lie in the transcendence of artificial barriers of perception, but its future may likewise depend upon the creation of new forms of representation, and the collective negotiation of which barriers should remain intact.

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[1] The event which took place in 2006 is commonly referred to using the acronym 23C3, a designation that is updated annually and is specific to each year's congress.

[2] The following description was pieced together from interviews with individuals who were present at the camp, and from Internet media produced in connection with the event. A selection of this online content is provided below:

> http://events.ccc.de/camp/2007/Intro/
> http://hackstory.net/Hacker_Camps
> http://chaosradio.ccc.de/media/video/chaos-communication-camp-2007.m4v.

[3] Hackerspaces and similar co-working spaces influenced by the hackerspace model can now be found in locations around the world. For a user-maintained list of active spaces, see: http://hackerspaces.org/wiki/List_of_Hacker_Spaces.

[4] See: https://www.noisebridge.net/wiki/Vision#Excellence.

[5] See: https://www.noisebridge.net/wiki/Consensus_Process.

[6] Tor (an abbreviation for "The Onion Router") is a free software that is intended to facilitate anonymous activity on the Internet. While this might easily be construed as a tool for conducting illicit activity, it is generally perceived by the community as enabling the ability of individuals and hackers to conduct business and express themselves freely on the Internet without fear of government surveillance or reprisal. A more detailed description of Tor and Noisebridge's connection to the project can be found at the following URLs:

> https://ssd.eff.org/tech/tor
> https://noisebridge.net/wiki/Tor.

[7] Coleman does emphasize the importance of the ephemeral, face-to-face interaction found at large hacker conferences such as Defcon (2013: 28, 31), but she overlooks more stable, continuous forms of in-person community such as those attended to in this paper, and the routine social interaction they engender.

[8] For a sample of this versatile application of the term hacking, one need only peruse the various e-mail discussion lists used by individuals involved in the Noisebridge community. See: https://www.noisebridge.net/wiki/Mailinglist.

[9] See no. 4 above.

[10] In addition to the more immediate effects resulting from physical self-deprivation in terms of sleep or food, there is also the gradual development of manual dexterity—evident

in the speed with which some computer programmers can navigate a keyboard, and thereby communicate with the computer.

[11] This is evident in the hands-on approach to learning, or a belief in what is sometimes described as education through "doing" that is often encountered in the context of hackerspace communities.

[12] This is evident in the temporary roles sometimes assumed by individuals within the hackerspace, often with the expectation of fulfilling some highly specific function. An example of this is the regular election of officers by the community, or those who volunteer to act as temporary mediators to resolve a dispute.

[13] The following description was formed using interviews performed with the c-base community, and information presented during the Chaos Communication Congress held in 2006 (see: http://www.youtube.com/watch?v=SSe029HcBS8). A great deal of information regarding this hackerspace can also be found at the following URL: http://c-base.de.

[14] A number of prominent examples are provided in Levy's (1984) narrative including the group which emerged at MIT from the late 1950s through the 1960s (see especially pp. 3-97), the Homebrew Computer Club (see pp. 195-218), the Stanford Artificial Intelligence Lab (SAIL) (see pp. 131-136), and the group which arose around the creation and operation of the People's Computer Company (see pp. 164-168), to name a few.

[15] Due to increasing rent and the growing size of the community, the group eventually moved to a larger space also located in Berlin. This posed little threat to the continued development or consistency of the c-base legend, however, in that the change in space was describe simply in terms of a move from one point above the buried space station to another. The restoration described by the c-base community is also one of a social *pattern*, and not merely the figurative excavation of a physical space station.

[16] Metalab in Vienna is a notable example of the early European hackerspaces that appeared following the creation of c-base.

[17] For a "catalogue" of design patterns outlining the basic elements necessary for the establishment of a successful hackerspace, see: http://events.ccc.de/congress/2007/Fahrplan/events/2133.en.html. This document was created in response to interest expressed by hackers in the U.S. who had attended the 2007 Chaos Communication Camp. Among the important design elements mentioned in this presentation are the inclusion of bathrooms, showers, and the sale of beverages such as maté to raise money for the space.

[18] DIY is a general term used here in reference to a long-standing tradition in the U.S. of informal, self-determined forms of production—often relying on designs and instructions shared by a diffuse community of individual producers through a host of mainstream

publications and popular media. The early presence of a DIY orientation among hackers can also be seen in Levy's reference to a "Hands-On Imperative" (1984: 8, 308) among computer hackers as early as the 1950-60s.

[19] See Levine and Heimerl (2008) for a brief introduction to this social and practical genre.

[20] See: http://biocurious.org.

[21] See: http://mothership.hackermoms.org.

[22] See: http://oaklandmakerspace.wordpress.com.

[23] See no. 5 above.

[24] Do-ocracy is a term that is frequently encountered in hackerspace communities. For a brief description of this principle provided by Noisebridge, see: https://www.noisebridge.net/wiki/Vision#Do-ocracy. Another example of how this principle is interpreted can be found in the orientation notes created by Pumping Station One (also referred to simply as PS:One) in Chicago. See: https://docs.google.com/document/d/19tHEZ6nsFLY02IJH8Pw80VztQ2lqxOU2wtrdG7Mo9WU/edit.

[25] In the case of Noisebridge, this focus on education and learning-by-doing is clearly evident in the classes frequently held at Noisebridge—which were invariably found to be free-of-charge, unless some material or equipment is required in which case a small fee might be levied to cover the cost—and in the communities stance towards those without prior knowledge or skill in a particular area. Specifically individuals without prior experience are encouraged to come to the space, interact, and learn. Noisebridge also welcomes students and parents, and during my research, children were often present in the space attending classes or visiting on class fieldtrips organized by area schools. Turning to another example of this, Mothership Hacker Moms embraces homeschooling, and even offers workshops for mothers interested in learning about this alternative approach to education (see: http://mothership.hackermoms.org/about/faq/).

[26] See: http://makezine.com.

[27] Examples of this are Mothership Hacker Moms and Ace Monster Toys, hackerspaces which are also both located in the Bay Area.

[28] One example of this is the LOL hackerspace previously mentioned.

[29] The creation of makerspaces in public schools is part of an ongoing challenge from the U.S. federal government connected to its funding of the Maker Movement (see no. 32 below). Chicago Public Library also recently announced the installation of a makerspace at

its Harold Washington Library branch in downtown Chicago. a copy of this press release can be found at the following URL: http://www.chipublib.org/aboutcpl/cplpr/2013/innovation_lab.php.

[30] As evidenced by the hosting of maker events at Google, and Ford's sponsorship of TechShop Detroit (see: http://techshop.ws/ts_detroit.html).

[31] Entrepreneurship is a consistent theme emphasized by Anderson (2013) throughout his recent book on the Maker Movement titled *Makers: The New Industrial Revolution*.

[32] This concern among hackers is also identified by Levy under remarkably similar circumstances related to the U.S. Department of Defense's funding of the MIT computer lab during the Vietnam War (1984: 120-122). In the case of the Maker Movement, Dale Dougherty of Maker Media issued a response to concerns surrounding government funding which can be found here: http://makezine.com/2012/04/04/makerspaces-in-education-and-darpa/.

[33] Retrieved 6-30-13: https://www.noisebridge.net/wiki/About.

[34] The provision of a key is considered to be one of the numerous benefits of paid membership—in that while the space is often occupied, there is no assurance that someone is monitoring the video surveillance system or listening for the buzzer. In addition, the door buzzer is located close to what is known as the "hacker tables" or "hacker alley," and those seated at these tables are sometimes in a mental state referred to as "deep hack mode" (Coleman, 2013: 13). Hackers claim that this is a condition brought on by a need for extreme concentration, and constitutes a state of mind that involves blocking out any external distractions from one's conscious awareness—a mental state that is also sometimes accompanied by violent outbursts, chairs or equipment being flung across the room, or other expressions of both frustration and elation. As a result, it can take quite some time to gain entry into the space if someone is not paying attention to the door.

[35] The entire third floor of the building.

[36] It is tempting to treat software as an infinitely scalable resource. In the case of F/OSS, however, it is perhaps more accurate to think software as a virtual infrastructure, in that software is not merely *consumed* by users. It is rather *developed* recursively by user-developers.

[37] DORA stands for "DORA Open Robot Assistant." This acronym reflects a tongue-in-cheek affinity among computer hackers for acronyms lacking in particular depth, and which constitute names in and of themselves. A prominent example of this is the free GNU operating system developed by the famous MIT hacker Richard Stallman (Levy, 1984: 434). Like DORA, GNU is a recursive acronym which stands for "GNU's Not Unix," in reference to

the proprietary UNIX operating system. Gnu is also an indigenous name for the African wildebeest, a comical depiction of which serves as the logo for the GNU project.

[38] For more information, see: http://www.dorabot.com; http://wiki.dorabot.com.

[39] See slides 72-76 in presentation on hackerspace design patterns available at the following link: http://events.ccc.de/congress/2007/Fahrplan/events/2133.en.html.

[40] This sentiment is also expressed in The Owner's Manifesto (Mister Jalopy, 2005) published by MAKE Magazine (see: http://archive.makezine.com/04/ownyourown/).

[41] Examples of such projects include debugging open-source software, performing science experiments using high altitude weather balloons, or simply the material enhancement of the space itself.

[42] The following news article presents a rather obvious example of this: http://www.bbc.co.uk/news/technology-19347120.

[43] See Marx (1978), pp. 70-81, 292-293.

[44] This is a recurrent theme in *A Hacker Manifesto* (2004). See especially pp. 152, 195, 203, 222, and 256.

[45] This emphasis on cultivating a clear moral code is especially evident among computer hackers and those involved in the development of F/OSS (Coleman, 2013: 38, 182; Kelty, 2008: 43; O'Neil, 2009: 179, 182).

[46] Examples of this ongoing debate regarding interactions that take place in the hackerspace abound in Noisebridge's e-mail discussion forum, and the word "excellence" is invoked with surprising frequency in the regular interactions of the group.

[47] Presentation given at Five Minutes of Fame (5MOF)—a regular event consisting of a series of short presentations on a variety of topics—held March 21, 2013.

[48] An example of a similar project being conducted at Genspace in New York can be accessed using the below link:

> http://genspace.org/event/20121107/1930/DIY%20Neuroscience:%20Controlling%20Behavior%20from%20the%20Inside

[49] For information on this bioluminescence project being conducted at Biocurious, see: http://biocurious.org/projects/bioluminescence/.

[50] The term wiki is used here in a general sense to refer to Cunningham's model, whereas Wiki is used to refer specifically to the open-infrastructure website which he developed. In outlining a general conception of the term wiki, Cunningham's website is approached on its own terms—that is, through a direct exploration of the website, and the content which Cunningham and Wiki's community of users have created. To access Wiki, see: http://c2.com/cgi/wiki?.

[51] A rather interesting page to this effect can be found on Wiki, see: http://c2.com/cgi-bin/wiki?WikipediaIsNotWiki

[52] The use of the wiki concept to describe communities which themselves use online wikis constitutes something of a recursive metaphor, which is unintentional and yet oddly appropriate for the recursivity so often apparent among hackers.

[53] This project is sometimes referred to by Cunningham simply as "Patterns." For more information, see: http://c2.com/cgi/wiki?PeopleProjectsAndPatterns.

[54] Retrieved 7-13-13: http://c2.com/cgi/wiki?InvitationToThePatternsList.

[55] The website is also programmed—albeit minimally—to evaluate contributors, which can in some cases result in a rejection of their content. For an example of this, see: http://c2.com/cgi/wiki?WikiAccessContentBlacklist.

[56] This subjective aspect of technological objects reflects Latour's argument that objects should be thought as actors possessing a multiplicity of agencies acquired from other actors—human and nonhuman—and not merely as passive intermediaries (2005: 37-42, 70-74).

[57] Examples of this can be found at the following pages in Wiki:

http://c2.com/cgi/wiki?WikiDesignPrinciples;
http://c2.com/cgi/wiki?WikiSocialNorms
http://c2.com/cgi/wiki?OneMinuteWiki.

[58] See: http://c2.com/cgi/wiki?WikiDesignPrinciples;
http://c2.com/cgi/wiki?OneMinuteWiki.

[59] See: http://c2.com/cgi/wiki?WikiDesignPrinciples.

[60] This is referred to as "squatting," and is perceived as undermining the emphasis placed on community, which is in turn treated as a fundamental aspect of the Wiki project. See: http://c2.com/cgi/wiki?WikiSquatting.

[61] These pages, or constellations of pages, are referred to as "Walled Gardens." See: http://c2.com/cgi/wiki?WalledGarden.

[62] Anonymous post retrieved 7-14-13 (original text in italics): http://c2.com/cgi/wiki?WalledGarden.

[63] The social could of course be defined more broadly as interactions occurring between humans, whether direct or mediated by space, material, objects, communications technologies, and so on—but as in the case of Latour, collectivity is relied upon more heavily throughout this paper to avoid confusion.

[64] These principles, some of which have already been discussed, are often reflected in the conversations that occur in the space, the content posted to the group's online wiki, and the discussions and debates which take place in the community's e-mail discussion forum.

[65] This emphasis on making tangible contributions to the community is often described in terms of technological practice, and as something which constitutes a "true" hack. Other activities which are not perceived as contributing to the technological practices of the community are therefore treated as not true forms of hacking. An example that was repeatedly mentioned by respondents regarded individuals who come to the space and "surf the Internet," or simply use the wireless Internet connection available at the space to access social networking sites such as Facebook. There were, however, individuals who called attention to the relative nature of what constitutes a "true" hack, and suggested that this was used by some members to disqualify legitimate forms of hacking—especially those that result in the production of something that lacks an immediately recognizable function.
[66] This is evident in a page added to the Noisebridge wiki, titled "What to do if the FBI/Secret Service/etc comes to 2169 investigating Internet traffic"—see: https://www.noisebridge.net/wiki/Noisebridge_Tor/FBI.

[67] In this sense, the broader network of hackerspace communities might even be thought as a constantly evolving wiki which is itself composed of countless sub-wikis—or a wiki of wikis, if you will.

[68] This orientation towards critical reflection regarding the social aspects of collectivity is largely missing from Kelty's narrative, which possibly leads him to portray communities of F/OSS developers as publics instead of complex forms of collectivity containing a distinctly social element. It is also possible, however, that this social aspect is less apparent in these communities, largely approached by Kelty in a virtual context.

[69] See Boellstorff's work on the subject, *Coming of Age in Second Life: An Anthropologist Explores the Virtually Human* (2008).

[70] This is oddly reminiscent of attempts at engineering a more egalitarian society shaped by a complete reordering of urban space evident in the megastructure design concepts that emerged from the Japanese metabolist movement of the 1960s. See Zhongjie Lin's *Kenzo Tange and the Metabolist Movement: Urban Utopias of Modern Japan* (2010).

[71] This project is organized by individuals involved with the Brooklyn hackerspace known as NYC Resistor. See: http://www.hackert0wn.com.

[72] This aversion to a revolutionary social project is also identified by Kelty in his work on F/OSS (2008: 67).